

A new species of the fish genus *Arctozenus* from the Kerguelen Islands, with comments on the lost teeth in adults (Aulopiformes: Paralepididae)

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Abstract

A new cryptic species of spotted barracudina, *Arctozenus australis* **sp. nov.**, is described from the Kerguelen Islands, in the Indian Ocean sector of the Southern Ocean. It differs from the only congener, *Arctozenus risso* (Bonaparte, 1840), in the reduction of pigments on body, a more slender body, and longer head, snout and jaws. A neotype is designated for *Paralepis risso* Bonaparte, 1840 and *Paralepis borealis* Krøyer in Gaimard (1847). Note on synonymy of *Paralepis risso* is provided. Observation of adults of *Notolepis annulata*, *Magnosudis prionosa* and *Paralepis coregonoides* found loss of teeth on jaws and gill arches, suggesting more species in the subfamily Paralepidinae may commonly possess this character in adults.

Key words: Pisces, taxonomy, *Arctozenus risso*, *Arctozenus australis*, Arctic, Southern Ocean

Introduction

During a recent visit by the first author to the Muséum national d'Histoire naturelle fish collection, a number of specimens either unidentified or only with rough identification in the family Paralepididae were examined. Among the specimens provisionally identified as *Arctozenus risso* (Bonaparte, 1840) there were several obviously different species, including some misidentifications of other genera and species. Detailed examination on the materials come from two geographical areas, the North Atlantic, and the Kerguelen Islands, Indian Ocean sector of the Southern Ocean, revealed two different species of *Arctozenus*.

The genus *Arctozenus* was established by Gill (1864) for *Paralepis borealis* Krøyer in Gaimard (1847), a junior synonym of *A. risso* (see Post, 1972:145) and also a junior homonym of *Paralepis borealis* Reinhardt, 1837 (= *Paralepis coregonoides* Risso, 1820). Another available generic name *Profundisudis* was established for *Paralepis coruscans* Jordan & Gilbert, 1881 as a subgenus under *Notolepis* by Harry (1953). Post (1972) noted that Harry (1953) reassigned *Paralepis risso* to *Notolepis*, a decision which threatened the validity of *Notolepis*. A request had been sent to ICZN to place *Arctozenus* on the official Index of Rejected and Invalid Names in Zoology, but appeared not to have been accepted. *Arctozenus* (*Profundisudis* is junior synonym) and *Notolepis* are currently recognized as distinct genera with their own type species (Post, 1987) and there is unlikely to be confusion.

Among the synonyms of *A. risso*, three species were described on the basis only of figures, four of them do not have primary types, and only the holotype of *Paralepis coruscans* is extant. All these synonyms have been assigned to a single species, the oldest available name, *Paralepis risso* Bonaparte, 1840 (= *Arctozenus risso*). However, the status of some of them are still doubtful.

By comparing large numbers of specimens from a wide geographical spread, and data from previous reliable references, we recognized a new species from Kerguelen Islands, originally identified as *A. risso* (see Duhamel *et al.*, 2005), but differs from the real *A. risso* in several aspects. A discussion of the synonyms of *Paralepis risso* Bonaparte, 1840 is provided.

Other specimens examined in the MNHN collection were identified as species of *Paralepis*, *Magnisudis* and *Notolepis*. We found one example in each genus that exemplifies the loss of jaw teeth in adults. A detail description of each species example is provided.

Materials and methods

Specimens examined are held at the Muséum national d'Histoire naturelle (MNHN) and Zoological Museum, University of Copenhagen, Copenhagen (ZMUC). They were collected during midwater research cruises, or as by-catch of fishery operations (bottom trawl). Additional otolith collections were also available from unretained specimens.

Measurements were made point to point, except where otherwise indicated. Standard length (SL), measured from tip of the upper jaw to base of caudal fin (posterior margin of hypural plate), is used throughout. Head length (HL), is measured from tip of snout to posterior margin of opercle. Head depth is the vertical depth through middle of eye. Body depth is measured at the greatest depth. Predorsal, prepelvic and preanal lengths are measured from tip of snout to origins of these fins, respectively. Snout length is measured from tip of snout to anterior margin of orbit. Eye diameter is the horizontal bony width of orbit. Interorbital width is the narrowest width of upper margins of eyes. Upper-jaw length is measured from tip of snout to posterior end of maxilla. Lower-jaw length is measured from tip of lower jaw to posterior end of articular bone (usually right below the middle of eye). Anal-fin base is measured from base of first ray to the insertion of the last ray. Caudal peduncle depth is the narrowest distance between upper and lower margin; caudal peduncle length is the vertical distance between end of anal-fin base and caudal-fin base.

Lateral-line scales are counted to origins of dorsal, pelvic, anal fins and the total number. Vertebral numbers are shown as prehaemal, predorsal, prepelvic, preanal, caudal and total vertebrae.

Comparisons are done with those provided in Post (1987), unless otherwise indicated. Abbreviations: DFO = Dorsal-fin origin; VFO = Pelvic-fin origin; AFO = Anal-fin origin; D–V = horizontal distance between origins of dorsal and pelvic fins; D–A = horizontal distance between origins of dorsal and anal fins.

The COI sequences of mtDNA region were assembled and aligned and Pair-wise Kimura 2-parameter distance (K2P) genetic distance was calculated by using MEGA 7.0 (MEGA 7.0.21 version) (Kumar *et al.*, 2016). A neighbour-joining (NJ) phylogenetic tree of the K2P with 1000 bootstrapping replications was also constructed by using same program.

Taxonomy

Subfamily Paralepininae (*sensu* Post, 1987)

Arctozenus Gill, 1864

Diagnosis. Body covered by cycloid scales, moderately stout to slender; VFO behind vertical of DFO; gill rakers with multiple rows of short teeth, which never slender or needle-like; scales on body smaller than lateral-line scales; teeth on anterior portion of palatine enlarged and fang-shape; two rows of tooth pairs on lower jaw.

Note on synonymy of *Paralepis risso* Bonaparte, 1840. Six available names are associated with *Arctozenus* and all are currently recognized as *Arctozenus risso* (Bonaparte, 1840) (Post, 1987).

The original description of *Paralepis risso* Bonaparte, 1840 was based on description and a drawing by Cuvier in Cuvier & Valenciennes (1829:357–359, pl. fig. 66; reproduced in Fig. 1A). The specimen was collected from Mediterranean Sea off Italy and apparently lost (Post, 1972:143).

Richardson (1845:51, pl. 30, figs. 6–7) described *Prymnothonus hookeri* based on drawing of a figure “provided by Dr. Hooker” without voucher and locality. They also mentioned: “It is evidently a Muraenoid fish, closely allied to the Congers.” Post (1972:157) suggested that “Dr. Hooker’s specimen cannot be assigned with any certainty to any nominal species. Apparently it was a postlarval paralepidid, probably either *N. rissoi* or *P. coregonoides borealis* or *P. atlantica*.” The species is treated herein as *incertae sedis* in Paralepididae.

Krøyer in Gaimard (1842–1856) provided a drawing which he recognized as *Paralepis borealis* (although not specified, it is assumed to be Pl. 16B, fig. 1). However, the voucher appears not to have been retained. Gill (1864) established the new genus *Arctozenus* based on this drawing. Post (1972) recognized that the drawing was actually a *Paralepis risso* (as *rissoi*). *Paralepis borealis* Reinhardt, 1837 he recognized as a subspecies of *Paralepis coregonoides*, and later synonymized with that species (Post, 1973, 1987). Examination on the holotype of *Paralepis coregonoides borealis* Reinhardt, 1837 (ZMUC P.2348432) has confirmed the synonymization of these two names.

According to the Code (ICZN, online version), the name *Paralepis borealis* of Krøyer in Gaimard (= *A. risso*) is treated as available (Article 11.10), and should be the type species of *Arctozenus* (Article 69.2.4).

Jordan & Gilbert (1881) described *Paralepis coruscans* based on a single specimen collected from the north-eastern Pacific Ocean. The fish is well described and illustrated. Rofen (1966) synonymized the species with *N. rissoi* (= *A. risso*), a decision supported by Post (1972, 1987). The holotype has a relatively deep body (13 times in fork length in original description) and we concur with this decision.

Lütken (1892) described *Paralepis kroyeri* based on a drawing by Krøyer in Gaimard (1842-1856, pl. 16B, fig. 1). This is evidently the same species described by Krøyer. The species has sometimes been treated as a valid subspecies (i.e. Rofen, 1966), however, Post (1968, 1987) has suggested latitude-related changes in morphometrics and meristics, and synonymized it with *A. risso*.

Whitley & Phillips (1939) described *Prymnothionoides regani*, new genus and new species, based on a drawing of a juvenile collected at Cape Maria van Diem (northern tip of North Island, New Zealand) provided in Regan (1916: pl. VII, fig. 3). Harry (1953) placed the genus under *Notolepis* with a question mark and without further discussion. In his catalogue of types, Post (1972) records that “Regan’s figure cannot be assigned with any certainty to any nominal species” and “The International Commission of Zoological Nomenclature has been requested to place the generic and specific name on the Official Index of Rejected and Invalid Names in Zoology.” However, the later seems never been gazettes and published, and Post (1973) later suggested that the species is questionably a synonym of *Notolepis risso* (Bonaparte, 1840). The species is treated herein as *incertae sedis* in Paralepididae.

***Arctozenus risso* (Bonaparte, 1840)**

English name: Spotted barracudina

Figs 1A–C, 2A,B, 3A,B, 5A,B; Table 1

Paralepis risso Bonaparte, 1840: pl. 124, fig. 2 (No types known; neotype designated herein).

Paralepis kroyeri Lütken, 1892:228 (No types known; neotype designated herein).

Paralepis coruscans Jordan & Gilbert, 1881:411 (Type locality: Port Townsend harbor, Washington, U.S.A.).

Designation of neotype. According to Post (1972), there is no type for *Paralepis risso* Bonaparte, 1840 or *Paralepis borealis* Krøyer in Gaimard (1847). A neotype is designated for both in order to stabilize the diagnosis of the species, according to Article 75.3 of *The International Code of Zoological Nomenclature* (ICZN, online version).

Neotype. MNHN 2018-0264 (266 mm SL), out of MNHN 2000-5431, “Thalassa” station b229, 62°16′58.8″N, 10°10′1.2″W, off Faroe Islands, North Atlantic Ocean, 676–696 m, 11 May 1975; also designated as neotype of *Paralepis borealis* Krøyer in Gaimard, 1847.

Non-types. All from Atlantic Ocean. MNHN 2000-5429 (3, 256–258) “Thalassa” station b570fq109, and MNHN 2000-5430 (4, twisted), 46°51′00″N, 59°37′1.2″W, 384–384, 28 Jul. 1975. MNHN 2000-5431 (27, 212–280), “Thalassa”, station b229, collected with neotype. MNHN 2000-5432 (26, 191–250), “Thalassa”, station b230, 62°25′1.2″N, 9°33′00″W, 566–588 m, 12 May 1975. MNHN 2000-5433 (2, 226–236), “Thalassa”, station b328fq67, 50°37′1.2″N, 53°33′00″W, 311–312 m, 20 Jul. 1975. MNHN 2000-5434 (1, 261), “Thalassa”, station b346fq85, 49°28′1.2″N, 50°12′00″W, 320–322 m, 22 Jul. 1975. MNHN 2000-5435 (1, 235), “Thalassa”, station b344fq83, 49°34′1.2″N, 50°16′1.2″W, 336–382 m, 22 Jul. 1975. MNHN 2000-5436 (1, 253), “Thalassa”, station b322fq61, 53°9′00″N, 51°58′58.8″W, 940 m, 17 Jul. 1975. MNHN 2000-5437 (1, 267), “Thalassa”, station b228, 62°43′1.2″N, 9°39′00″W, 494–502 m, 11 May 1975. MNHN uncat. (1, 199, photo only), tissue no. BPS-1960, 45°56′N, 4°16′, Bay of Biscay, France, northeast Atlantic Ocean, 20 Oct. 2011.

Diagnosis. Body uniformly and densely covered with chromatophores; body depth 9–16 times in SL, a short, deep head, depth at middle of eye 3.5–4.1 in HL, VFO under dorsal-fin base, and anterior lateral-line scales subequal in depth and length.

Description. Following data is for neotype with of non-types (n = 54) in parentheses, except where otherwise indicated.

Dorsal-fin rays 9 (9–10, usually 9); pectoral-fin rays 13 (13–14, usually 13); pelvic-fin rays 9 (9–10, usually 9); anal-fin rays 31 (30–33). Vertebrae (n=15): prehaemal 39 (39–41), caudal 46 (43–46), predorsal 37 (37–39), prepelvic 40 (40–43), preanal 54 (52–56), and total 85 (83–87). Gill rakers 8 (7–10) on upper limb, 27 (28–31) on lower limb, 11 (11–13) on ceratobranchial, 16 (14–18) on hypobranchial. Lateral-line scales: predorsal 38 (37–39), prepelvic 40 (40–42), preanal 53 (52–55), total 66 (65–70).

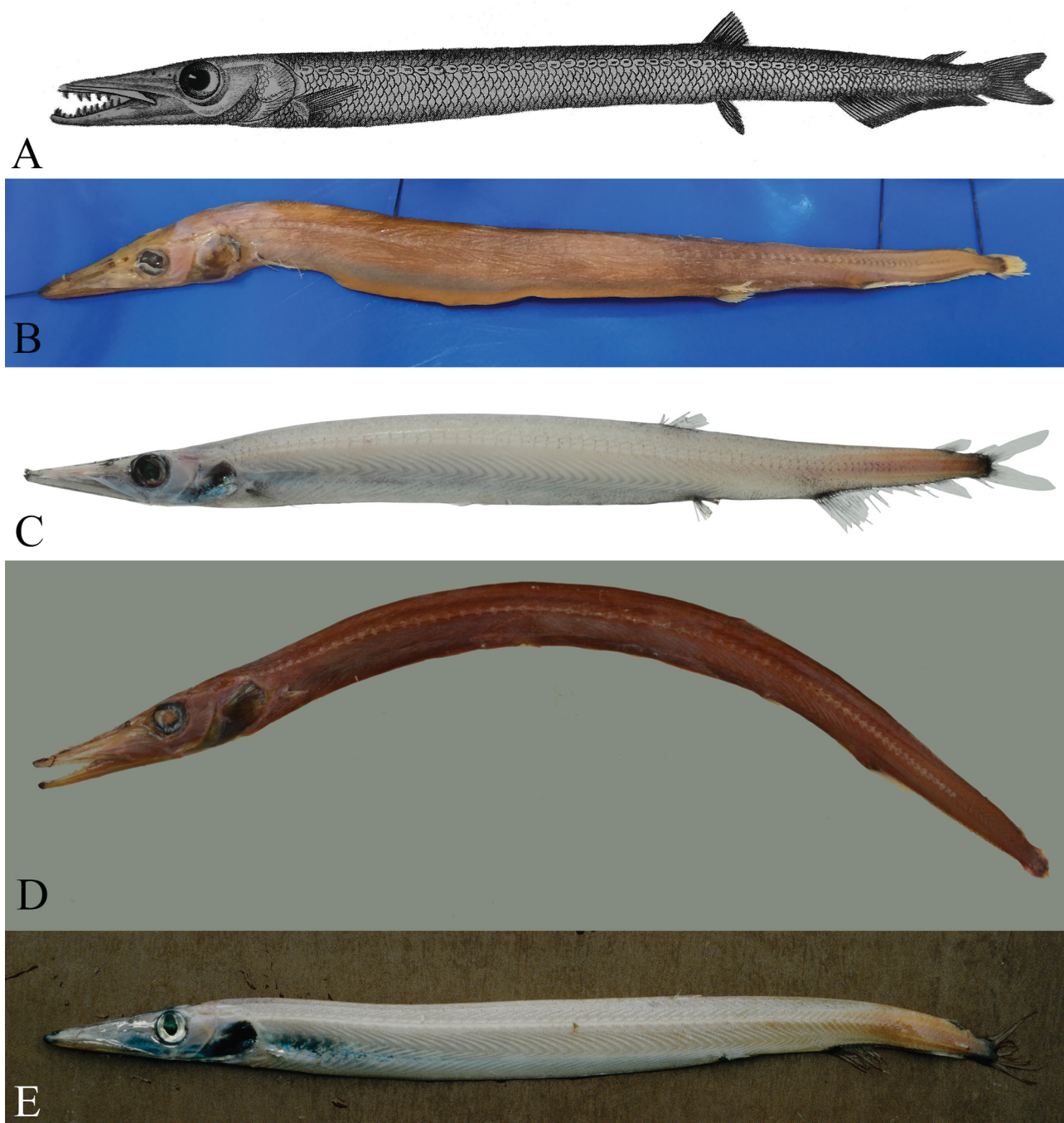


FIGURE 1. A–C. *Arctozenus risso* (Bonaparte, 1840). A. Original drawing which *Paralepis risso* Bonaparte, 1840, reproduced from Cuvier in Cuvier & Valenciennes, 1829: pl. fig. 66). B. Neotype of *Paralepis risso* Bonaparte, 1840, MNHN 2018-0246. C. MNHN uncat. (tissue no. BPS-1960), 199 mm SL, photo by Samuel Iglésias. D–E. *Arctozenus australis* **sp. nov.** D. Holotype, MNHN 2000-0260. E. Fresh condition, one of paratypes.

Body elongate and compressed in individual smaller than 250 mm SL, becoming stouter and thicker in specimens more than 250 mm SL, greatest depth 11.2 in SL (9.5–13.0 in specimens >250 mm SL; 12.9–15.8 in specimens <250 mm). Caudal peduncle subequal to eye diameter. Posterior half of abdomen with slightly developed flap. Ventral adipose fin absent.

Head moderately long, pointed (Fig. 2A), its length 4.9 (4.6–5.0) in SL, its depth slightly (<250 mm SL) to much lower (>250 mm SL) than the trunk. Mouth terminal, slender, its gape extends to about one eye diameter in front of the eye; lower jaw not upturned at tip, its tips bearing a black non-ossified tissue. Eye large, bony diameter 5.9 (5.4–6.6) in HL. First suborbital bone slightly expanded anteriorly, second long, about twice the third, third to fifth stout, the sixth well expanded dorsally. Interorbital space narrow and flat, its width 8.5 (8.5–9.8) in HL. Two ridges on each side of interorbital space, the inner one extended forward to tip of snout. Premaxilla rectangular,

closely attached to maxilla; maxilla extending to slightly, but clearly, less than one eye diameter in front of the eye. Two nostrils closed together, above tip of maxilla or slightly behind. Opercle with low ridges forming radiated pattern (when skin removed), posterior margin slightly indented. Tongue surrounded by narrow fleshy membrane.

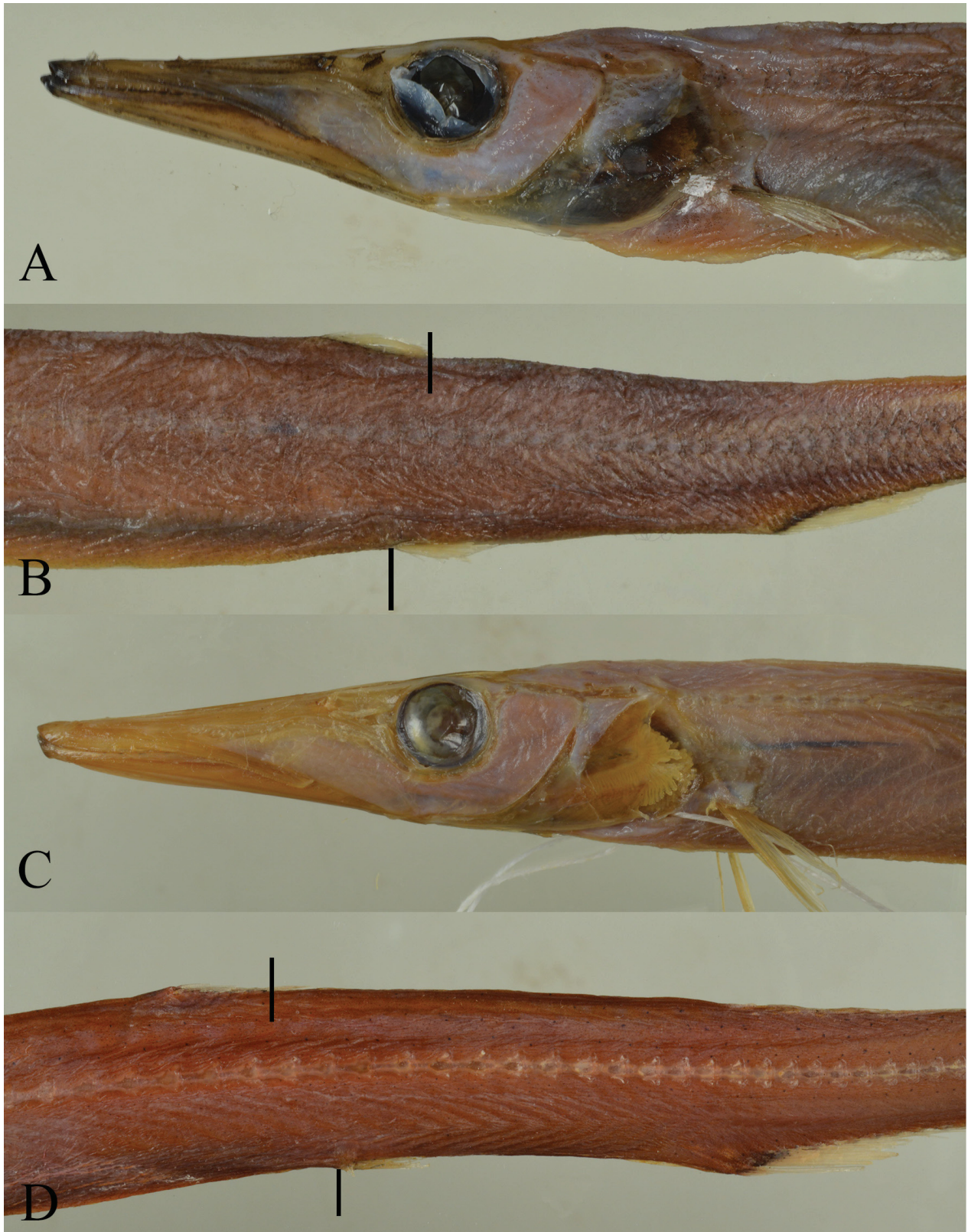


FIGURE 2. Comparison of head and relative position of DFO and VFO of *A. risso* and *A. australis*. A-B. Neotype of *A. risso*. C. Paratype of *A. australis*, MNHN 1992-1218. D. Holotype of *A. australis*. Bars indicate end of dorsal-fin base (upper) and origin of pelvic fin (below).

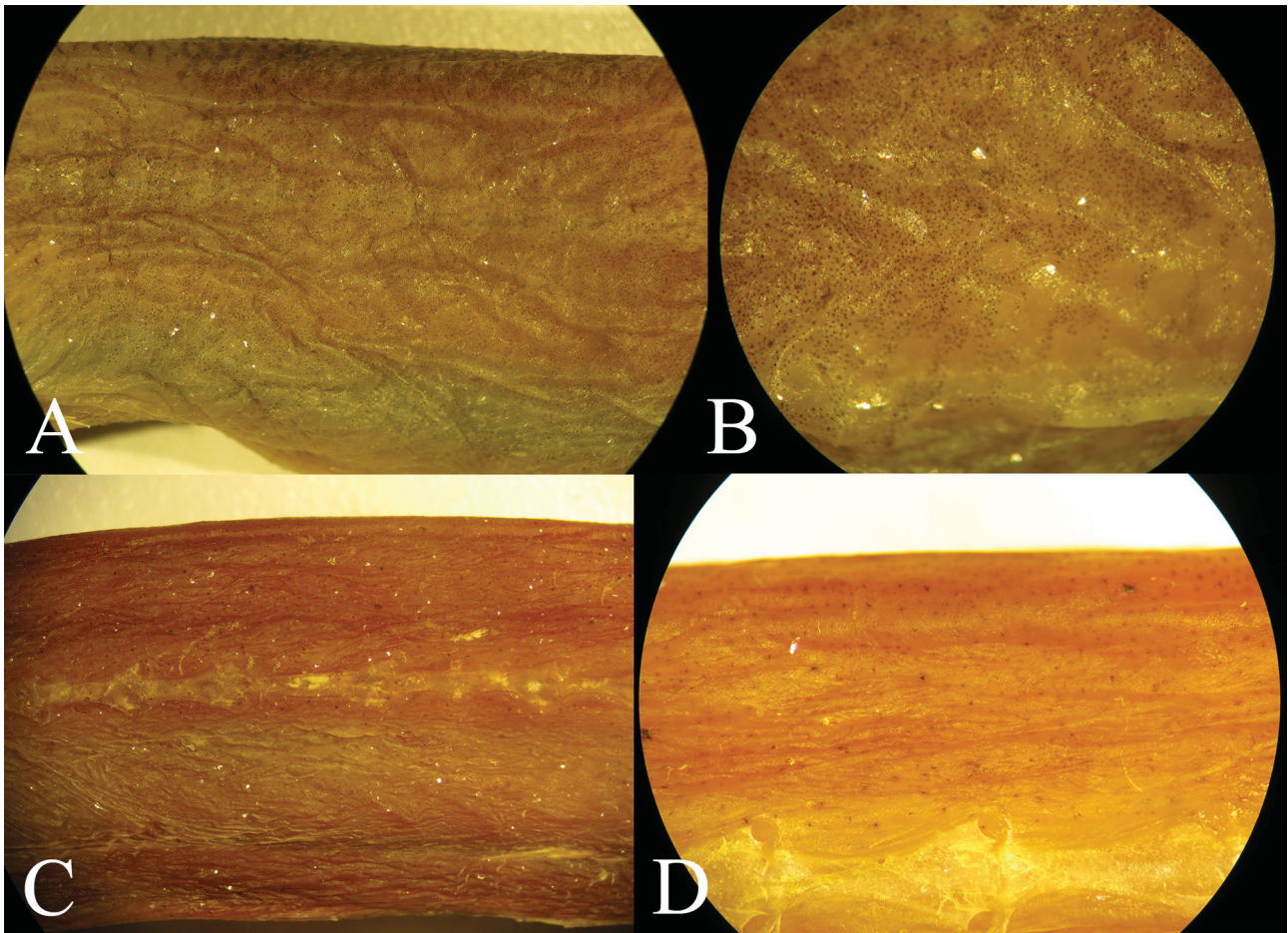


FIGURE 3. Microscopy photographs of anterior trunk region (A, C) and close-up of above lateral line at same region (B, D). A–B. Neotype of *A. risso*. C–D. Holotype of *A. australis*. Both with complete skin, but most scales lost.

DFO at about posterior third of standard length, predorsal length 1.5 (1.5–1.6) SL. Pectoral fin above ventral margin, about lower level of gill cover, the uppermost ray at about same level of lower margin of eye. VFO below posterior half of dorsal-fin base, never behind that, pre-pelvic length 1.4 (1.4–1.5) in SL. Anal fin originating at posterior sixth of standard length, pre-anal fin length 1.2 (1.2) in SL. Anal fin base short, 7.2 (6.7–7.2) in SL. Dorsal adipose fin over posterior end of anal-fin, about 1.5 its base length before caudal-fin base, its base length less than eye diameter.

Two to four small fangs at front of upper jaw, followed by a closet row of tiny blade-like teeth along maxilla. Vomerine teeth absent. Two rows of fangs on anterior palatines, in 5 or 6 (5–8) widely-spaced pairs, those in outer row fixed and much smaller than those in inner row, which are depressible, the third or fourth especially enlarged, followed by single row of small fangs posteriorly. Two or three small fangs at front of lower jaws, followed by a short row of small teeth, then two rows of fangs posteriorly, forming 14 (10–14) widely-spaced pairs, those in outer row fixed and smaller than those in inner row which are depressible. About 2 irregular rows of small teeth on each side of outer portion of tongue.

Gill rakers as described by Post (1987, figs. 1c, d), present on most gill arches, shield-shaped, each with three or four rows of small teeth. Pharyngeal teeth from short, slender, forming two long patches, anterior patch long triangular with 3 irregular rows; posterior patch oval with up to 6 rows. About 10 scattered teeth on fifth ceratobranchial, in one irregular row. Gill filaments present on the first to fourth arches, absent on fifth. Anterior half of fifth gill arch connected to the forth by membrane. Pseudobranch present, in a shallow chamber above first gill arch.

Body completely scaled, mostly lost leaving distinct pockets. Lateral-line scales originating from above pectoral girdle and running along upper third of the flank to above about over middle of anal-fin base. Anterior lateral-line scales about twice as long as its height, gradually becoming smaller and narrower posteriorly, but not to the degree as in members of *Lestrolepinae*; two large pores on posterior margin of each scale. Luminous organs absent.

Coloration (Figs. 1B,C, 2A,B, 3A,B). Preserved specimen with body generally blackish, densely covered with fine chromatophores; some much larger spots on dorsum and posterior half of body visible without magnification; dorsal surface of head and snout blackish; tips of jaws black. Gill chamber entirely blackish; mouth cavity mostly pale with irregular patches of fine chromatophores. Peritoneum black. All fins hyaline, except for pigmented upper rays of pectoral fin.

Distribution. Circumglobal in temperate and tropical seas including the Arctic (Post, 1987), but probably not present in the Southern Ocean (see below).

Remarks. The world distribution of this species is as provided by Post (1987) with one exception. In his list of specimens, one lot (WH247, 61°10'S, 56°07'W, 180 mm SL) was collected from Antarctic region (also see Post, 1987: fig. 2). We are not sure whether he measured this specimen so we could not judge this record. Post (1990) also recorded *A. risso* occurring in the Southern Ocean for which he recorded the body depth 5.9–7.7% SL and head length 21.8–27.5% SL which did not correspond with his previous data (Post, 1987: table 1). We believe this specimen to be the new species described below. Post (1987) divided the body depth of *A. risso* 8.0–11.5% SL (30°S) or 8.5–11.7% SL (30°N) which is similar to our specimens with body size more than 250 mm SL (7.7–10.6% SL, $n = 18$), but not these smaller than 250 mm SL (6.3–7.7%, $n = 36$). The presence of *A. risso* in Antarctic is doubtful.

***Arctozenus australis* sp. nov.**

New English name: Southern spotted barracudina

Figs. 1D,E, 2C,D, 3C,D, 4, 5A,B; Table 1

Holotype. MNHN 2000-0260 (281 mm SL), “La Curieuse” off Kerguelen Islands, “Ichthyoker” cruise, International Young Gadoid Pelagic Trawl (IYGPT), station 44, 49°58'S, 71°48'E, 350 m, 13 Feb. 1998.

Paratypes. Thirteen specimens, 255–287 mm SL. MNHN 1992-1217 (1, 265), “Skif” off Kerguelen Islands, SKALP cruise, 48°39'00"S, 71°01'58.8"E, Rectangular Midwater trawl (RMT) station 3, 600–700 m, 28 Feb. 1988. MNHN 1992-1218 (2, 270–280), “Kalper”, SKALP cruise, Bottom trawl, 47°16'58.8"S, 70°46'58.8"E, 295 m, 27 Apr. 1988. Collected with “La Curieuse” off Kerguelen Islands, “Ichthyoker” cruise, IYGPT, near the type locality at same period: MNHN 2000-0254 (1, 257), station 6, 50°22'S, 72°56'E, 345 m, 6 Feb. 1998. 2000-0255 (1, 274), station 135, 48°36'S, 71°10'E, 378 m, 5 Mar. 1998. 2000-0256 (1, 255), station 133, 48°35'S, 71°16'E, 188 m, 5 Mar. 1998. 2000-0257 (1, 287), station 28, 50°17'S, 73°59'E, 265 m, 12 Feb. 1998. 2000-0258 (1, 261), station 28, 50°17'S, 73°59'E, 265 m, 12 Feb. 1998. 2000-0259 (1, 272), station 84, 49°12'S, 71°21'E, 205 m, 25 Feb. 1998. 2000-0261 (1, 270), station 127, 49°02'S, 71°03'E, 420 m, 1 Mar. 1998. 2000-0262 (1, 258), station 28, 50°17'S, 73°59'E, 265 m, 12 Feb. 1998. 2000-4962 (1, 275), station 452, 48°20'S, 71°55'E, 160 m, 1 Apr. 1999. 2000-4969 (1, 291) station 508, 49°32'S, 71°03'E, 350 m, 20 Apr. 1999.

Non-types. Four specimens, 245–270 mm SL. MNHN 1981-1251 (1, 245), “Vzmorie” 50°00'S, 70°49'58.8"E, Commercial bottom trawl, 250–300 m, 5 Dec. 1980. MNHN 1999-1219 (2, 268–270), “La Curieuse” off Kerguelen Islands, “Ipeker” cruise, IYGPT, station 32, 49°10' 58.8"S, 71°16'58.8"E, 350 m, 4 Mar. 1995. MNHN 2004-1110 (1, damaged), same cruise as previous lot, station F3, 47°06'S, 74°37'E, 160 m, 17 Apr. 2000. MNHN 2011-0452 (broken, posterior part cut off for genetic analysis), “Poket 2” cruise, station 3, 46°24'14.4"S, 67°33'43.2"E, off Kerguelen Islands, 791–792 m, 28 Aug. 2010; genetic voucher, field number POKER9202, BIN number BOLD: ABW7005.

Diagnosis. A species of *Arctozenus* differing from the only congener in having a pale body with lower half mostly devoid of chromatophores; body slender, its depth 14–19 in SL; a slender head, its depth at middle of eye 4.3–5.1 in HL. Compared to similar size specimens (>250 mm SL) of *A. risso*, *A. australis* has relatively slender body (5.2–7.3%, vs. 7.7–10.6% SL); the ratio of snout length/eye diameter relatively large 3.1–3.9 (vs. 2.7–3.4); origin of pelvic fin slightly but clearly behind dorsal-fin base (vs. usually below dorsal-fin base); and anterior lateral-line scales long, about twice as long as its height (vs. width subequal to the height).

Description. Following data are presented for holotype with paratypes in parentheses, except where otherwise indicated. Meristic values in square brackets are for all specimens, including 3 non-types when available; values were taken from both sides when paired.

Dorsal-fin rays 9 [9(13), 10(1)]; pectoral-fin rays 12 [11(3), 12(22), 13(3)]; pelvic-fin rays 9; anal-fin rays 30 [30(5), 31(8), 32(2)]. Vertebrae: prehaemal 39 [38(5), 39(6), 40(4)]; caudal 43 [41(1), 42(5), 43(5), 44(3), 45(1)]; predorsal 37 [36(3), 37(7), 38(6)]; prepelvic 41 [39(1), 40(5), 41(7), 42(2)]; preanal 53 [50(3), 52(8), 53(4), 54(1)]; and total 82 [79(1), 80(1), 81(2), 82(8), 83(2), 84(1)]. Lateral-line scales: predorsal 36 [35(1), 36(8), 37(11), 38(16)]; prepelvic 40 [40(13), 41(8), 42(7)]; preanal 52 [51(6), 52(9), 53(10), 54(1)]; total 63 [62(3), 63(9), 64(5), 65(7), 66(4)]. Gill rakers 9 (7–10) on upper limb (epibranchial) and 35 (26–35) on lower limb, 13 (10–13) on ceratobranchial and 22 (16–22) on hypobranchial.

Body elongate, strongly compressed, depth at deepest area 14–19 times in SL. Caudal-peduncle length subequal to eye diameter. Posterior half of abdomen with slightly developed flap. No ventral adipose fin, but a low fleshy ridge behind the pelvic fin.

Head slender, pointed, triangular in lateral view (Fig. 2C), its length 4.4 (4.2–4.6) times in SL, its depth slightly less than the depth of trunk. Mouth terminal, slender, its gape extends to slightly more than one eye diameter in front of the eye; lower jaw not upturned at tip, tip bearing a black non-ossified tissue. Eye relatively small, its diameter 6.9 (6.4–7.3) in HL. First bone well-expanded anteriorly, second long, about twice of the third, third to fifth stout, the sixth well-expanded dorsally. Interorbital space narrow, slightly concave, its width 11.3 (10.6–11.9) in HL. Two ridges on each side of interorbital space, inner one extends to tip of snout. Premaxilla rectangular, closely attached to maxilla; maxilla extends to about one eye diameter in front of the eye. Two nostrils closed together, both above tip of maxilla or slightly behind it. Opercle with low ridges under the skin forming radiated pattern, the posterior margin slightly indented. Tongue surrounded by narrow fleshy membrane.

DFO at about posterior third of standard length, pre-dorsal length 1.5 in SL. Pectoral fin above the ventral margin, about lower level of gill cover, its uppermost ray at about same level of lower margin of eye. VFO slightly but clearly behind dorsal-fin base (Fig. 2D), pre-pelvic length 1.4 in SL. AFO at posterior fifth of body, pre-anal fin length 1.2 in SL. Anal-fin base short, 6.7 (6.3–7.6) in SL. Dorsal adipose fin above rear end of anal-fin base, about 1.5 its base length before caudal-fin base, its base length less than eye diameter.

Two or three small fangs anterior upper jaw, followed by a close set row of tiny blade-like teeth along maxilla. Vomerine teeth absent. Two rows of fangs on anterior palatines, in 7 or 8 widely-spaced pairs, those in outer row fixed and much smaller than those in inner row, those in inner row which are depressible, the second and third especially enlarged, followed by single row of smaller fangs. Two or three small fangs at anterior lower jaw, followed by a short row of small teeth, then two rows of fangs, in 7–9 widely-spaced pairs, those in outer row fixed and much smaller than those in inner row which are depressible. About 2 irregular rows of small teeth on each side of outer portions of tongue.

Gill rakers as described in Post (1987, figs. 1c, d), present along most gill arches, shield-shaped, each bearing three or four rows of small teeth, those in inner row longest. Pharyngeal teeth from short, slender, forming two long patches, anterior patch long, triangular with two irregular rows, posterior patch oval with up to 6 rows. Few scattered teeth on fifth ceratobranchial, in one row anteriorly, more irregular posteriorly. Gill filaments present on first to fourth arches, absent in fifth. Anterior half of fifth gill arch connected to fourth arch by membrane. Pseudobranch present, as a shallow chamber above first gill arch.

Body completely scaled, mostly lost, leaving distinct pockets. Lateral-line scales originating from above pectoral girdle and running along upper portion of flank to above about middle of anal-fin. Anterior lateral-line scales slightly more than twice length of height, gradually becoming smaller and narrower posteriorly, but not to the degree as *Lestrolepinae*; one large pore at each corner of posterior margin of scales; pair of smaller pores between or slightly in front of the larger pores; pair of small pores at middle of each scale; one (sometimes 0 or 2) small median pore at front of each scale. Luminous organs absent.

Coloration (Figs. 1D,E, 3C,D). Fresh color silvery white. Most specimens with scales entirely lost; musculature milky white; slightly grayish dorsally and paler ventrally. Operculum black; snout and jaws irregularly blackish. Preserved specimens loosely covered by chromatophores and some much larger dots on upper half of body under the microscope; ventral half of body devoid of chromatophores, except for some scattered dots along the abdominal ridge. Dorsal surface of head and snout blackish; tips of jaws black. Gill chamber irregularly blackish; oral cavity mostly pale, blackish posteriorly. Peritoneum black. All fins hyaline, except for several upper rays of pectoral fin with pigment along inner surface.

Size. The largest specimen examined is 291 mm SL; reaching 316 mm SL around the Kerguelen area (Duhamel *et al.*, 2005).

Etymology. The specific name *australis* is Latin for “southern”, in reference to the distribution of the present species which appears restricted to the Southern Ocean.

Distribution. Currently described from the Kerguelen Islands (Kerguelen Plateau) (Fig. 4), Indian sector of the Southern Ocean, but probably occurring in other parts the Southern Ocean (see Remarks). A thermal range for the species would be cool-temperate waters to south polar seas close to the Polar front. Specimens have been collected mainly offshore (over depths >500 m) by pelagic gear in the upper mesopelagic layer (160–420 m) at night, suggesting diel vertical migration from deeper water. Some were by-catch of bottom trawl on the slope of the Kerguelen Plateau (480–800 m) (Duhamel & Hulley, 1993, Duhamel *et al.*, 2005) and South-Georgia (Gregory *et al.*, 2017).

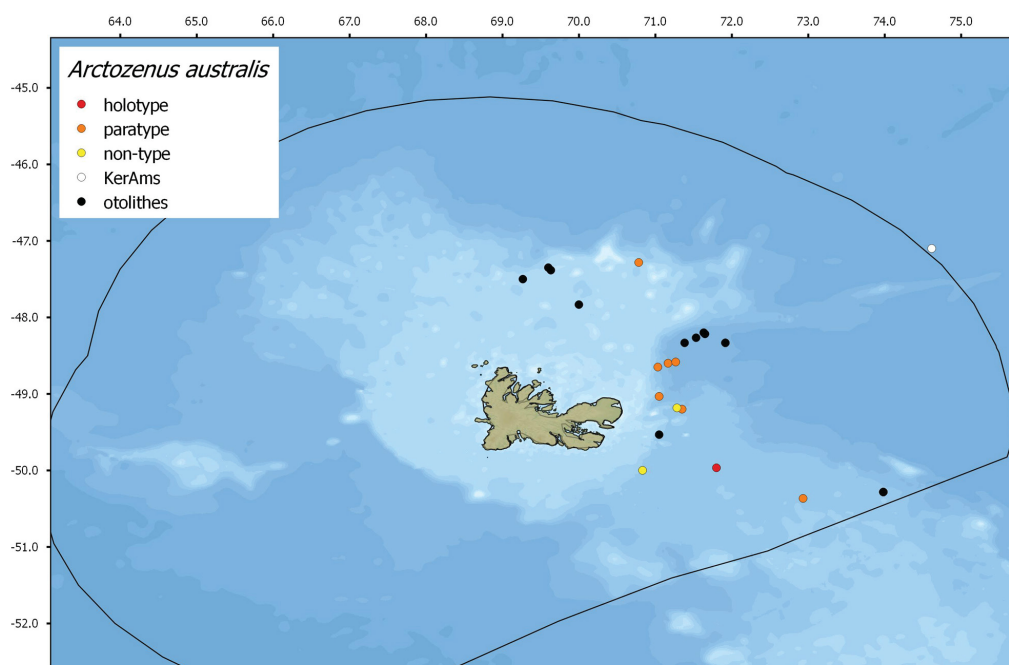


FIGURE 4. Distribution map of *Arctozenus australis*, including specimens from other cruises.

COI DNA sequence. The following sequence was registered to Barcode of Life Data System (BOLD; bin number: BOLD:ABW7005) (<http://www.boldsystems.org/>). CCTCTACCTGTTATTTGGTGCTTGGGCCGGAA TAGTGGGCACAGCGTTAAGCCTACTTATTCGGGCAGAACTAAGCCAGCCCCGGAGCCCTATTGGGTGAC GACCAAATTTATAATGTAATCGTAACAGCCCACGCTTTCGTAATAATTTCTTTATAGTTATACCTGTTAT GATTGGCGGTTTTGGAAATTGACTCATTCCCCTAATGATCGGGGCCCCCGACATAGCCTTCCCCCGAAT AAATAATATGAGCTTCTGACTTCTACCTCCATCTTTCCTCCTTCTCCTAGCTTCCTCTGCAGTAGAAGCC GGAGCCGGCACAGGGTGAACAGTGTATCCCCCTCTTGCCAGCAACTTAGCTCACGCTGGAGCCTCCG TTGACCTGACTATTTTTCCCTTCACTTAGCAGGGATCTCCTCTATTTTAGGTGCTATTAATTTTCATCACA ACTATTGTTAACATAAAACCACCTGCGATTACCCAATACCAGACTCCCTTATTCGTATGAGCGGTACTAA TCACCGCTGTACTTCTTTTACTTTCCCTCCCTGTCTTAGCAGCCGGAATTACGATACTTCTTACGGATCG GAATTTAAATACCAC

Comparisons. The species is very similar to the widespread *Arctozenus risso* in body proportions and meristics. Post (1987) provided the evidence that vertebral numbers change with latitude, and the body shape changed with the spawning stage. Our specimens agreed well with the data from southern Atlantic Ocean (30°S south). However, by examining the specimens closely, we found compared to the similar size of *A. risso*, our specimens have a paler body (Fig. 2), more slender body, and longer head, snout and jaws (Table 1; Fig. 5)

Specimens of *A. australis* examined were 255–291 mm SL, whereas *A. risso* were 191–280 mm SL in present study. Accordingly, the data set of the later is divided into two groups at 250 mm SL in order to compare the similar size of both species. Post (1987) provided data separated in two groups at ca. 140 mm SL for the Atlantic populations from 30°S south and 30°N north, respectively. The specimens greater than 140 mm SL in these two geographic regions showed similar body proportions.

Although all specimens have lost scales in the trawl, their skins are complete and scale pockets are detectable. There are scattered chromatophores on upper half of body above the lateral line and almost entirely devoid of chromatophores on lower half of body in all individuals in *A. australis* (Figs. 3C, D). In contrast, *A. risso* has entire body densely covered by chromatophores (Figs. 3A, B); while in smaller specimens, or individuals with most scales lost, the body will appear paler, there are always numerous melanophores around scale pockets visible under magnification.

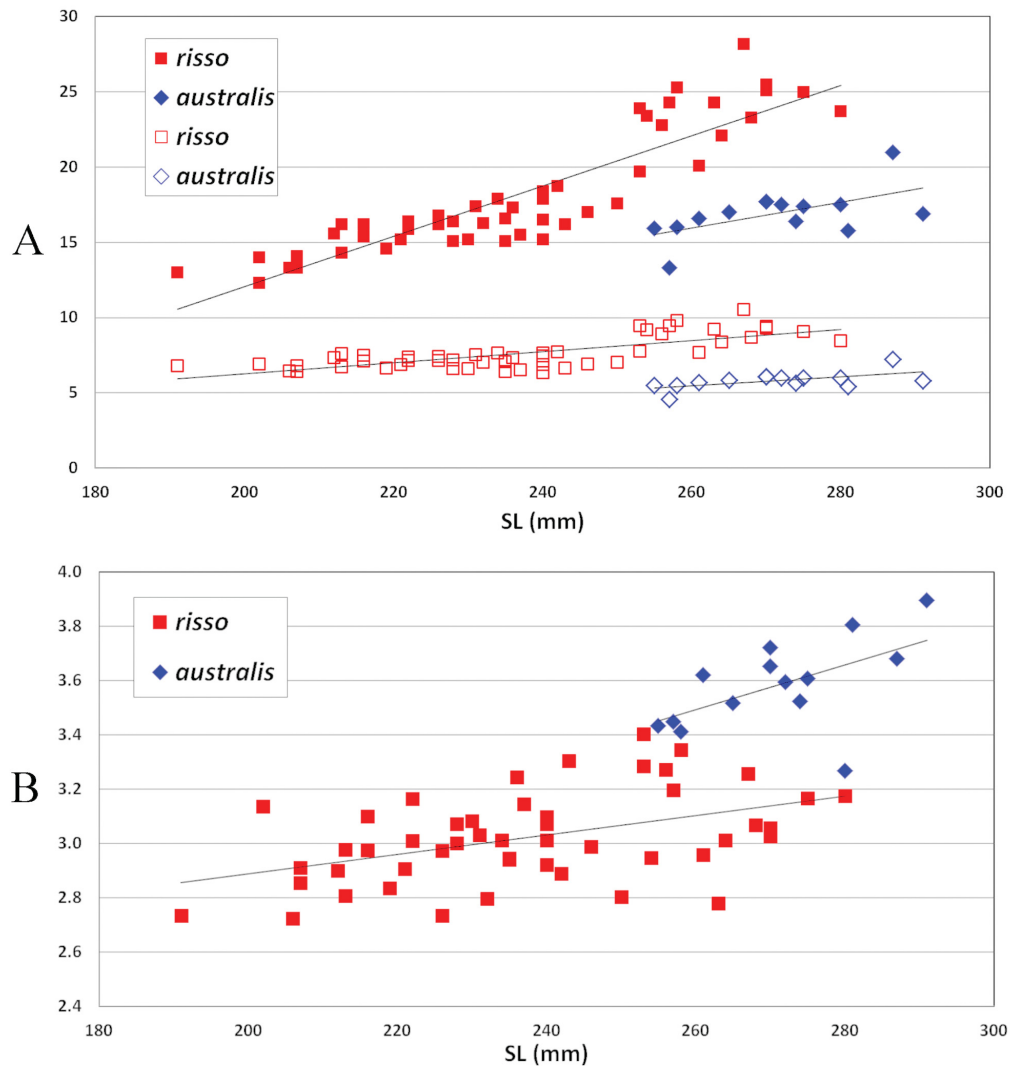


FIGURE 5. Comparison between two *Arctozenus* species. A. Body depth versus standard length; upper plots are original values (mm) and lower plots are % SL of specimens. B. Ratio of snout length/eye diameter versus standard length.

In all individuals of *A. australis* examined by us, the VFO is slightly, but clearly, behind the dorsal-fin base; whereas the VFO is always below the posterior half of dorsal-fin base in *A. risso* (see Fig. 2D vs 2B).

The body is relatively slender in *A. australis* than in *A. risso* (Table 1, Fig. 5A). In specimens of *A. risso* <250 mm SL, the body is relatively slender (body depth 6.3–7.7% SL), becoming distinctly deeper (7.7–10.6% SL) when >250 mm SL. In all specimens of *A. australis*, the body depth is clearly narrower (5.2–7.3% SL) than that of *A. risso* with body size >250 mm SL (Fig. 5A).

TABLE 1. Morphometric data of two *Arctozenus* species.

	<i>A. risso</i>			<i>A. australis</i> sp. nov.	
	Neotype	Non-type	Non-type	Holotype	All types
SL (mm)	266	252–280 (n = 27)	191–250 (n = 44)	281	257–291 (n = 13)
% SL					
HL	20.3	20.6 (20.0–21.7)	21.8 (20.6–22.9)	21.8	22.6 (21.6–23.8)
Body depth (BD)	8.9	9.0 (7.7–10.6)	7.0 (6.3–7.7)	5.6	6.2 (5.2–7.3)
Predorsal length	66.5	66.3 (64.4–68.5)	65.9 (65.0–67.6)	65.5	66.5 (65.5–67.0)
Prepelvic length	69.4	69.5 (68.2–71.9)	69.3 (68.2–70.4)	69.8	70.7 (69.8–72.2)
Preal anal length	83.5	82.4 (80.7–84.4)	82.4 (81.7–83.1)	81.9	82.0 (81.1–82.8)
D–V	3.6	3.2 (1.2–4.1)	2.8 (4.7–5.3)	5.1	4.2 (3.7–5.2)
D–A	16.6	16.1 (13.9–17.8)	15.5 (17.4–17.4)	16.8	15.6 (14.5–16.5)
Head depth (HD)	5.7	5.4 (5.1–5.8)	5.6 (5.3–6.3)	5.1	4.9 (4.4–5.2)
Snout length (SN)	10.5	10.6 (9.9–11.7)	10.9 (10.3–11.5)	11.8	11.8 (11.3–12.3)
Eye diameter (ED)	3.4	3.4 (3.2–3.6)	3.7 (3.3–4)	3.1	3.3 (3.1–3.8)
Interorbital width	2.4	2.2 (2.1–2.4)	2.4 (2.2–2.5)	1.9	2.0 (1.9–2.1)
Upper-jaw length	8.4	8.7 (8.3–9.1)	8.9 (8.5–9.2)	9.3	9.4 (8.9–9.7)
Lower-jaw length	12.2	12.2 (11.5–12.9)	12.5 (12.1–12.7)	12.7	13.1 (12.7–13.7)
Pectoral-fin length	6.8	6.6 (6.1–7.1)	6.9 (6.5–7.3)	-	7.2 (5.3–7.9)
Caudal-peduncle depth	1.8	1.8 (1.7–1.9)	1.9 (1.9–1.9)	1.7	1.8 (1.7–1.9)
Caudal-peduncle length	3.0	2.9 (2.5–3.2)	3.1 (2.8–3.3)	3.2	3.2 (2.9–3.5)
Anal-fin-base length	13.8	14.3 (13.8–15)	14.5 (14.2–14.8)	14.8	15.0 (13.1–15.8)
% HL					
Head depth	28.0	26.5 (24.8–28)	25.9 (24.5–28.9)	23.4	21.7 (19.6–23.4)
Snout	51.8	50.8 (48.5–54)	50.2 (48.2–52)	54.1	52.3 (50.7–55.2)
Eye	16.9	16.2 (15.2–17.8)	16.9 (15.2–18.5)	14.2	14.6 (13.7–15.5)
Interorbital	11.8	10.8 (10.2–11.8)	10.8 (10.2–11.5)	8.8	8.9 (8.4–9.4)
Upper jaw	41.7	41.8 (40.5–44.1)	40.8 (39.6–41.9)	42.5	41.3 (39.9–43.5)
Lore jaw	60.0	58.5 (56.2–60)	56.9 (55.3–58.5)	58.5	58.1 (56.3–61.6)
Pectoral fin	33.6	31.7 (28.9–33.6)	31.7 (29.5–35.4)	-	32.1 (23.2–36.6)
D–V %V–A	16.7	21.6 (16.7–23.3)	22.3 (18.2–26.8)	26.1	27.2 (24.5–32.6)
SL/BD	11.2	11.1 (9.5–13)	14.2 (12.9–15.8)	17.8	16.1 (13.7–19.3)
HL/BD	2.3	2.3 (1.9–2.7)	3.1 (2.8–3.4)	3.9	3.7 (2.9–4.4)
HL/HD	3.6	3.8 (3.6–4.0)	3.9 (3.5–4.1)	4.3	4.6 (4.3–5.1)
HL/SN	1.9	2 (1.9–2.1)	2.0 (1.9–2.1)	1.8	1.9 (1.8–2.0)
SN/ED	3.1	3.1 (2.8–3.4)	3.0 (2.7–3.3)	3.8	3.6 (3.1–3.9)

The head length is relatively slender in lateral view in *A. australis*, whereas that of *A. risso* is relatively deep posteriorly (Fig. 2C vs. Fig. 2A). The proportion of head length (21.6–23.8% SL) overlaps with that of *A. risso* <250 mm SL (20.6–22.9% SL), however, only slightly in specimens >250 mm SL (20.0–21.7% SL). All specimens of *A. australis* have a longer head (>58.4 mm) than those specimens of *A. risso* >250 mm SL (51.8–56.2 mm).

The head depth at middle of eye can separate the two species in all stages; 4.4–5.2% SL or 19.6–23.4% HL in *A. australis* and 5.1–5.8% SL or 24.8–27.2% HL in *A. risso* >250 mm SL and 5.3–6.3% SL or 24.5–28.9% HL <250 mm SL. The ratio of head length/head depth is clearly larger in *A. australis* (4.3–5.1), compared to that of *A. risso* (3.5–4.1 overall) (Fig. 5B).

The bony interorbital width is slightly narrower in *A. australis* (1.9–2.1% SL), compared to that of *A. risso* (2.1–2.5% SL). Both upper and lower jaw are slightly longer in *A. australis* (upper jaw 8.9–9.7% SL and lower jaw 12.7–13.7% SL), compare to that of *A. risso* (upper jaw 8.2–9.2% SL and lower jaw 11.7–12.9% SL).

The eye is generally smaller in *A. australis* (13.7–15.5% HL) reflected by the relatively slender head, whereas that is relatively large in *A. risso* (15.2–18.5% HL), reflected by the relatively short head (Figs. 2A vs. 2C).

Genetics. The COI sequence of *A. australis* (603 bp) was compared with 5 sequences of *A. risso* from several localities in Atlantic Ocean uploading to the BOLD, including GLF165-14 (Greenland), SCFAC825-06 (Canada), NBMF015-15 (Norway), MAECO010-06 (Atlantic Ocean), and ARC 28243 (Canada). There were a total of 584 positions analyzed in the final dataset. The K2P distances among *A. australis* and the five *A. risso* are 0.048–0.052, whereas the K2P distances among 5 *A. risso* are 0.000–0.007. Fig. 6 shows the neighbour-joining (NJ) phylogenetic tree of the K2P distances among the six sequences analyzed. The five sequences of *A. risso* forming a monophyletic group, whereas *A. australis* is clearly separated from them. The result supports the establishment of the new species in present study.

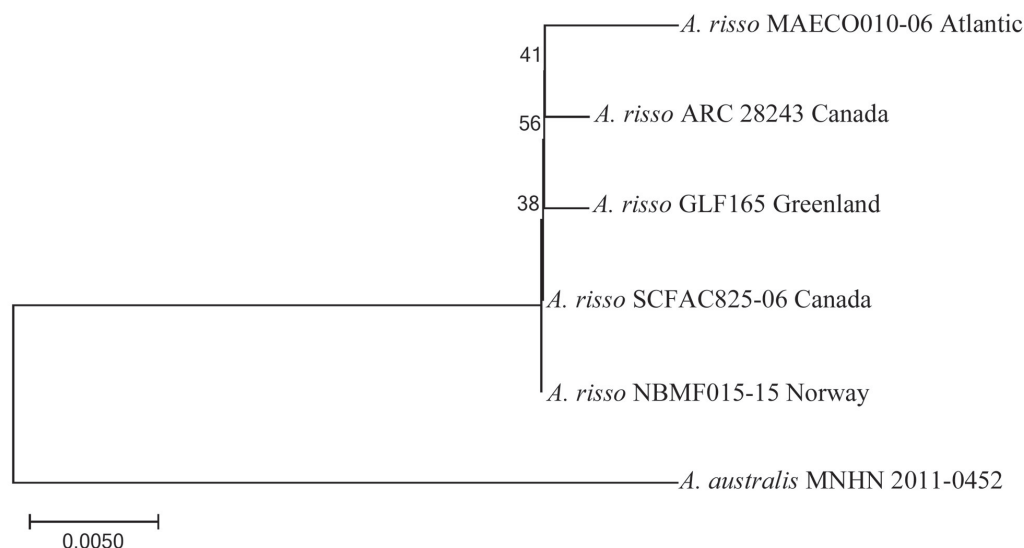


FIGURE 6. Neighbour-joining (NJ) phylogenetic tree of the K2P distances among *A. risso* (5 sequences) and *A. australis* (1 sequence).

Remarks. All specimens examined were collected from off Kerguelen Islands over a 20-year period (1980–2000). However, it cannot be excluded that some records from the South Atlantic Ocean (or Southern Ocean) might be the same species. Although Post (1987) provided data from 30°S south in South Atlantic Ocean, his specimens have body depth 8.0–11.5% SL so are not likely to be *A. australis*. Post (1990) provided data of the specimens (collected at 40°S south) with body depth 5.9–7.7% SL, which is not consistent with the values provided by Post (1987). We were unable to locate his material, so were not able to verify the measurements, but his specimens may not be *A. australis*.

Stewart (2015) reported two distinct populations of *A. risso* in the Northern and Southern Hemispheres, however, no analysis was provided. The photo provided in Stewart (2015: fig. 82.1) shows the VFO is clearly under dorsal-fin base and thus most likely a *A. risso*, not *A. australis*. Kenchington *et al.* (2017) provided the result of DNA barcoding from Northern Hemisphere *Arctozenus*, which distinguished basin-scaled cryptic species in Atlantic and Pacific Oceans. Accordingly, the genus needs further investigation.

Notes on three genera with ontogenetic loss of teeth and gill rakers

The following three genera, each with one example, are very different from their siblings in loss of the gill rakers and teeth on jaws, or some with rudimentary teeth. Post (1987) mentioned that “the lack of gill rakers and teeth has turned to be a common feature of many Alepisauroid species, indicating maturity of the specimen.” (p.115). However, he noted that *Magnisudis* with “loss of gill rakers and teeth in adults not observed” (p. 79, in Key) and again “probably no loss of gill rakers in adults” (p.88). Here we provided three cases, one species each in *Notolepis*, *Magnisudis* and *Paralepis*, with loss of gill rakers and teeth, assumable secondary loss at sexual maturity. These may suggest that the loss of gill rakers and/or teeth in adults is common in the subfamily Paralepidinae, although not occur in all members.

Notolepis annulata Post, 1978

Notolepis annulata Post, 1978:10, fig. 2 (type locality: Antarctic Ocean, 50°47'S, 50°01'W, depth 2000–2050 meters). Post, 1987:101. Post, 1990:140. Duhamel *et al.*, 2005:154.

Material examined. MNHN 2000-0284 (in poor condition), “Kerguelen de Trémarec”, Bottom trawl 64, 49°16'1.2"S, 67°6'0"E, Kerguelen Island, Southern Ocean, 16 Mar. 1997.

Description. Dorsal-fin rays 11; pectoral-fin rays 11/11; anal-fin rays 25; pelvic-fin rays 9. Scale and vertebral counts not available due to condition of the specimen.

Body slender, body depth ca. 17 in SL. Head long, its length ca. 4.4 in SL. Snout slender and pointed; eye moderately large, 3.7 in snout length. Two nostril closed together, at about one eye diameter before eye and slightly behind vertical of posterior end of maxilla. Lower part of opercle and subopercle divided into branches. Mouth gape extends to slightly before the nostrils. Caudal peduncle longer than eye diameter.

Pectoral fin moderately long, not especially filamentous. DFO and VFO slightly behind middle of the fish. DFO slightly behind VFO, about above anterior third of pelvic fin. Anus right behind VFO, about same level of DFO. Dorsal adipose fin damaged, but with very long base evidently.

Scales cycloid, with a mix of sizes, irregularly arraigned; scales mostly embedded under skin; lateral-line complete, extending to caudal-fin base, each scale with very long upper and lower extensions, extending to dorsal and ventral margin of body.

No trace of teeth on gill arch, pharyngeal arches and upper jaw. Teeth on palatines and lower jaw rudimentary, tiny and scattered.

Body deep brown with many regular pale bands created by the extensions of the lateral-line scales; all fins darker.

Remarks. The species is undoubtedly a *N. annulata* because the highly modified lateral-line scales. The scale structure is highly distinct compared to other members in Paralepidinae. This is the first observation of the loss of teeth on the jaws and gill rakers in *N. annulata*. We also examined 18 large adults of *Notolepis coatsorum* Dollo, 1908 collected from the Southern Ocean and all possess well-developed jaw teeth and gill rakers. Thus, the loss of teeth and rakers may not occur in *N. coatsorum*.

Magnisudis prionosa (Rofen, 1963)

Paralepis atlantica prionosa Rofen, 1963:1 (type locality: Antarctic, from a whale stomach).

Magnisudis prionosa (Rofen, 1963): Post, 1987:95. Duhamel *et al.*, 2005:152. Stewart, 2015:591.

Specimen examined. MNHN 2000-0453 (ca. 562 mm SL; nape broken), “Tangaroa”, Halipro 2 cruise, station bt41, 25°46'58.8"S, 167°10'58.8"E, New Caledonia, Coral Sea, Pacific, 1317–1383 m, 14 Nov. 1996.

Description. Dorsal-fin rays 11; pectoral-fin rays 20 (19 on left side); anal-fin rays 22; pelvic-fin rays 9. Lateral-line scales: prepelvic 31; predorsal 32 (33); preanal 48 (47); total 63 (61); transverse scale rows below LL ca. 22–25. Vertebrae: predorsal 33; prepelvic 34; preanal 48; total 70; numbers of prehaemal and caudal vertebrae not available.

Body moderately slender, slightly compressed. Head robust, its length about 4.4 in SL. Interorbital space flat, with a low straight ridge on each side extending from near tip of snout to dorsal surface of skull. Snout moderately long, stout, bluntly pointed at tip. Eye large, 2.8 in snout length. Two nostrils closed together, both clearly before level of posterior end of maxilla by about half eye diameter. Mouth gape extending to below nostrils. Posterior tip of maxilla about half eye diameter in front of eye. Caudal peduncle longer than eye diameter.

Pectoral fin moderately long, not especially filamentous. DFO and VFO clearly behind middle of the fish. VFO slightly behind DFO, below anterior third of dorsal-fin base. Anus well behind posterior tip of suppressed dorsal and pelvic fins. Dorsal adipose fin with short base, much smaller than eye diameter, gap between adipose fin and base of caudal fin about three times adipose-fin base.

Scales small, cycloid, scale rows between lateral line and ventral margin estimated ca. 22–25. Lateral-line scales enlarged, slightly higher than wide. Lateral-line runs to near the end of anal-fin base.

No trace of gill rakers and teeth on jaws and palatines. Teeth on pharyngeal plates tiny forming two large patches.

Body more or less uniformly blueish black, paler on upper and lower margins of lateral line; darker on ventral surface and fins. Adipose fin with pale base. Anus white. Peritoneal membranes black.

Remarks. We identified the specimen as *M. prionosa* from the distribution range (Southern Hemisphere) and 70 total vertebrae, based on Post (1987: 89; in Key). The specimen is in quite good condition, except where the nape region was badly damaged. It is a female with free eggs in ovaries; probably in the final stage of spawning.

Paralepis coregonoides Risso, 1820

Paralepis coregonoides Risso, 1820:253 (type locality: Nice, France, northwestern Mediterranean Sea). Post, 1987:116.

Specimen examined. MNHN 2001-2742, 221 mm SL, Mediterranean Sea, Villefranche/mer, France, Dec. 1970, coll. Inconnu.

Description. Dorsal-fin rays 9; pectoral-fin rays 16; anal-fin rays 23; pelvic-fin rays 9. Lateral-line scales: prepelvic 30 (31 on left side); predorsal 32 (32); preanal 47 (48); total 57 (58); transverse scales rows below lateral line ca. 10. Vertebrae: prehaemal 33; caudal 37; predorsal 31; prepelvic 33; preanal 47; total 70.

Body moderately slender, compressed. Head robust, deeper than the rest part of body, head length 4.0 in SL. Interorbital space flattened, with a low straight ridge on each side extending from near tip of snout to dorsal surface of skull. Snout moderate long, stout, bluntly pointed at tip. Eye large, 2.9 in snout length. Two nostrils closed together, slightly less than one eye diameter before the eye, right above tip of maxilla. Mouth gape extending to slightly behind middle of snout (clearly before nostrils). Caudal peduncle slightly longer than eye diameter.

Pectoral fin moderately long, the uppermost ray slightly lower than lower level of eye. Origins of dorsal and pelvic fins clearly behind middle of the fish. Origin of pelvic fin below anterior third of dorsal-fin base. Anus well behind posterior tip of appressed dorsal and pelvic fins. Adipose fin with short base, much smaller than eye diameter, about two fin bases before the caudal-fin base.

Scales small, cycloid. Estimated 10 rows between lateral line and ventral margin. Lateral-line scales enlarged, slightly higher than wide. Lateral-line runs to near the end of anal-fin base. Three scale rows between lateral line and dorsal fin base.

No trace of teeth on jaws, palatines and gill arches; two large patches of rudimentary teeth on pharyngeal arches.

Remarks. The identification based on the collecting site, slender snout, nostrils right above tip of maxilla, pelvic-fin origin below anterior third of dorsal-fin base, and 33 prehaemal and 70 total vertebrae (Post, 1987: 110; in Key).

Post (1987) mentioned there are 25 specimens collected from American continental slope (about 33°N, 76°W), the western Atlantic Ocean. Our specimen is the first record of the adult *Paralepis coregonoides* with loss of gill rakers and teeth.

Comparative material

***Magnisudis prionosa*:** MNHN 2002-3340 (1, 320), “Kerguelen de Trémarec”, commercial bottom trawl, 48°7′8.4″S, 71°22′58.8″E, Kerguelen Island, 570–688 m, 9 Nov. 2001. ***Notolepis coatsorum*:** MNHN 1991-5990 (11), “Polarstern”, Epos 3 cruise, station 26bnp6, 74°36′00″S, 29°40′58.8″W, Weddell Sea, Southern Ocean, 798–799 m, 10 Feb. 1989. MNHN 1991-5988 (2), “Polarstern”, Epos 3 cruise, station 259bnp5, 74°39′00″S, 29°25′58.8″W, Weddell Sea, Southern Ocean, 649 m, Feb. 1989. MNHN 1991-5989 (5), “Polarstern”, Epos 3 cruise, station 260bnp5, 74°40′58.8″S, 29°12′00″W, Weddell Sea, Southern Ocean, 605 m, Feb. 1989. ***Paralepis coregonoides*:** MNHN 1999-0668 (2, 157–161), “Thalassa” Talus 99 cruise, station d291, 47°43′1.2″N, 8°13′1.2″W, off France, northwestern Atlantic Ocean, 1289 m, 17 Apr. 1999. MNHN 2000-0449 (1, 121), “Tangaroa” Halipro 2 cruise, station bt42, 25°34′1.2″S, 167°25′1.2″E, New Caledonia, western Pacific Ocean, 1132–1160 m, 11 Nov. 1996. ZMUC P.2348432, holotype of *Paralepis coregonoides borealis*, Qaqortoq, Greenland [Note: upper jaw broken; distance

from tip of lower jaw to caudal-fin base 259 mm; each gill raker with 3 needle-like teeth, the innermost one longest; VFO below dorsal-fin base; eye diameter ca. 2.8 in snout length (estimated) and scales large.]

Acknowledgements

HCH would like to thank the team of ichthyological collection of Muséum national d'Histoire naturelle (MNHN). Special thanks to Zora Gabsi and Jonathan Pfliger (MNHN) for curatorial assistance and Samuel Iglésias (MNHN) for providing the photograph of *Paralepis risso*. This study is support by MNHN and National Museum of Marine Biology & Aquarium of Taiwan.

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